Sage Grouse Landscape Genetics for Management And Conservation

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Sage Grouse Connectivity Outline

I. Background – Connectivity Principles

II. Sage Grouse Connectivity Project

Gene Flow

Why Do We Care About Gene Flow And Movement of Animals?

As some of our British parks are ancient, it occurred to me that there must have been long-continued close interbreeding with the fallow-deer (*Cervus dama*) kept in them; but on inquiry I find that it is a common practice to infuse new blood by procuring bucks from other parks.

changed, there can, I think, be no doubt but that a judicious cross with a good stock is of the greatest consequence, and is indeed essential, sooner or later, to the prosperity of every well-ordered park.

Livestock Breeders Have Known of the Dangers Of Close Related Breeding

*Milk production per cow per lactation increased from **17,444 lbs** to **25,013 lbs** from 1978 to 1998 for the Holstein breed.*

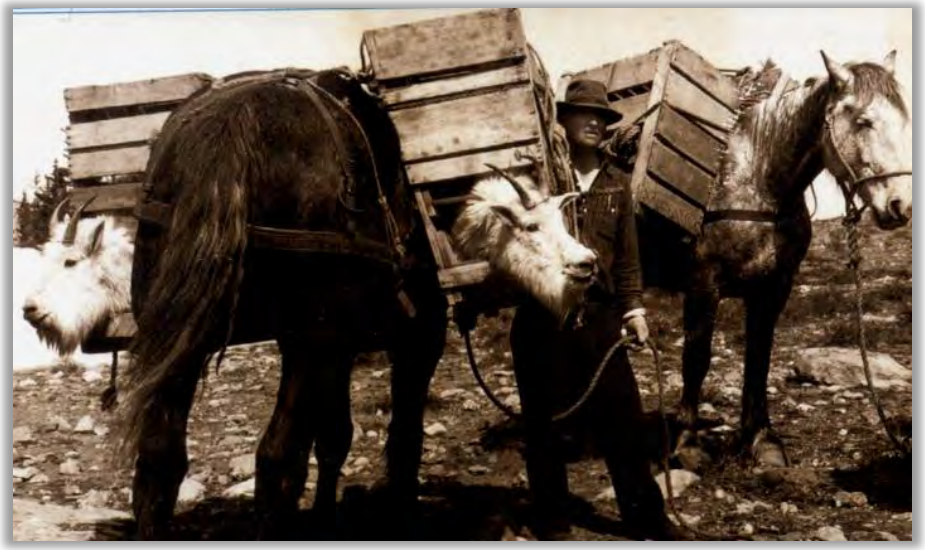
*High producing cows are increasingly difficult to breed and are subject to **higher health costs** than cows of lower genetic merit for production.*

(Cassell, 2001)

Without Movement and Gene Flow

- Inbreeding of Populations
- Loss of genetic diversity
- Depression of Population Fitness
- Suite of Demographic Problems Arise
  (As a consequence of inbreeding or alone)
- Increase in Extinction Risk

SOLUTION: OUTCROSSING – MANY APPROACHES



Cameras show wildlife use Highway 93 North overpass and tunnels

Story | Discussion | Image (6) | Font Size:

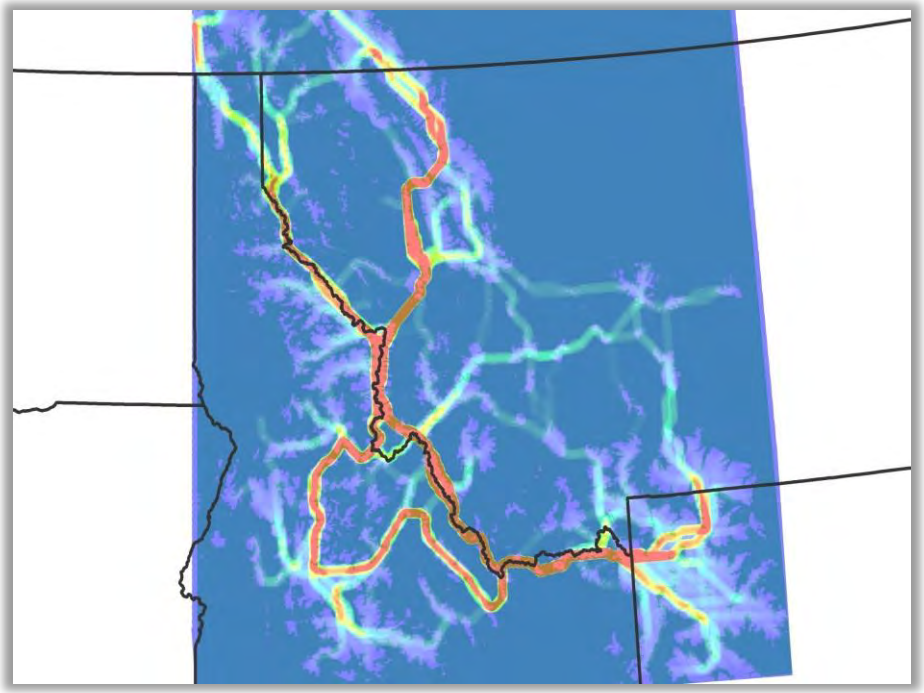
By VINCE DEVLIN of the Missoulian | Posted: Sunday, October 3, 2010 10:28 pm | Loading...

Bear crossing underneath U.S. Highway 93. Photo courtesy CSKT, MDT and WTI-MSU

EVARO - The People's Way, otherwise known as U.S. Highway 93 as it passes through the Flathead Indian Reservation, very much caters to critters, too, it appears.

Many folks like the moose story best.

When the large wildlife overpass north of here above the highway opened for its furry traffic, what appeared to be a bull moose was the first to christen it.



Most Effective Is through Good Land Stewardship Fostering Connectivity

Land purchase completes important wildlife corridor

August 13, 2010 by Lynn Knell 1 Comment
Filed under Business, Cranbrook, Environment, Kimberley, Local news

The Luke Creek land conservation purchase by the Land Conservancy of British Columbia is supported by Columbia Basin Trust, the BC Hydro Fish and Wildlife Compensation Program and the property's current owner, Teck. It is an important final step which completes the Luke Creek wildlife corridor. (Photos by TLC)

An important parcel of land at Luke Creek, between Kimberley and Cranbrook, has been acquired by the Land Conservancy of British Columbia (TLC) with the support of a Columbia Basin Trust (CBT) contribution of $200,000. The 123.7 hectare

Columbia Valley News

News is Filled with Actions Aimed at Increasing Wildlife Connectivity!

Environment on msnbc.com

More wildlife getting helped across the highway

Funding, studies, new attitu

FOXNEWS.COM HOME > U.S.

Protected Path Sought for Wyo. Antelope

Monday, March 03, 2008

By BOB MOEN, Associated Press Writer

FOX NEWS .com Fair & Balanced

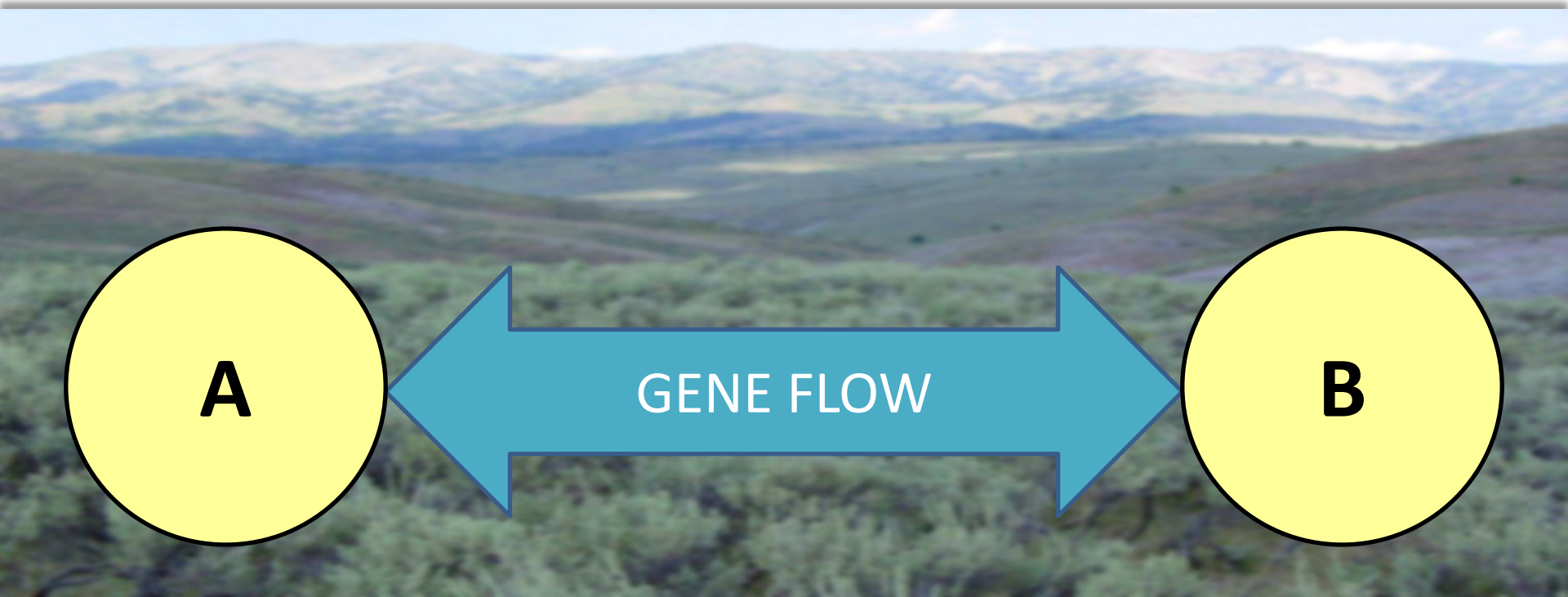
Anthony P. Clevenger / Western Transportation Institute

ildlife overcrossings in Banff National Park. To see a grizzly bear

ttom of the page.

Gene Flow

Gene Flow is the incorporation of genes into the gene pool of one population from other populations



How Much Gene Flow Is Enough?

The One-Migrant-per-Generation Rule in Conservation and Management

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Abstract: *In the face of continuing habitat fragmentation and isolation, the optimal level of connectivity between populations has become a central issue in conservation biology. A common rule of thumb holds that one migrant per generation into a subpopulation is sufficient to minimize the loss of polymorphism and heterozygosity within subpopulations while allowing for divergence in allele frequencies among subpopulations. The one-migrant-per-generation rule is based on numerous simplifying assumptions that may not hold in natural populations. We examine the conceptual and theoretical basis of the rule and consider both genetic and nongenetic factors that influence the desired level of connectivity among subpopulations. We conclude that one migrant per generation is a desirable minimum, but it may be inadequate for many natural populations. We suggest that a minimum of 1 and a maximum of 10 migrants per generation would be an appropriate general rule of thumb for genetic purposes, bearing in mind that factors other than genetics may further influence the ideal level of connectivity.*

Gene Flow

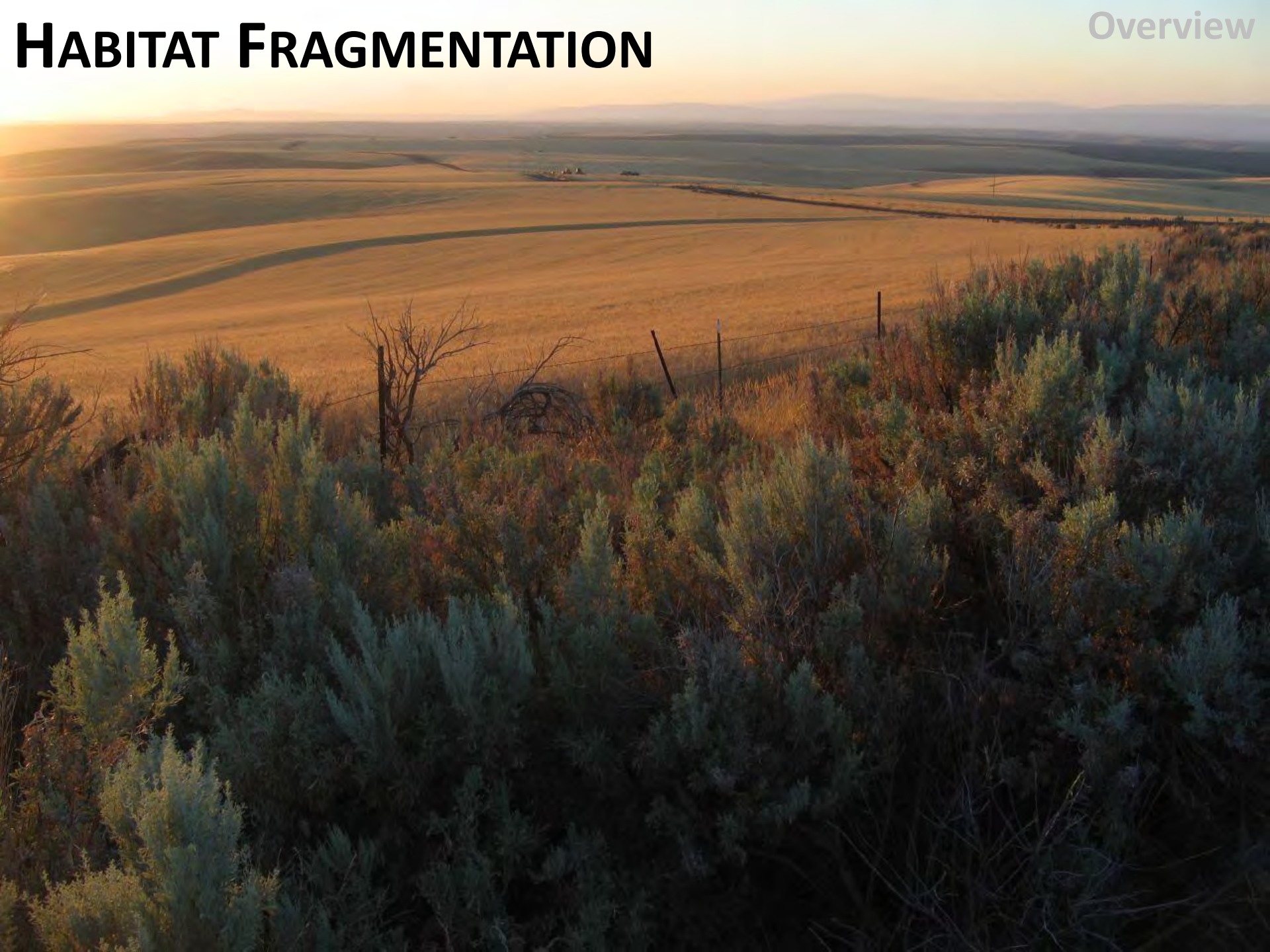
Are Animals Moving (and Breeding) From One Area to Another?

Overview


Overview

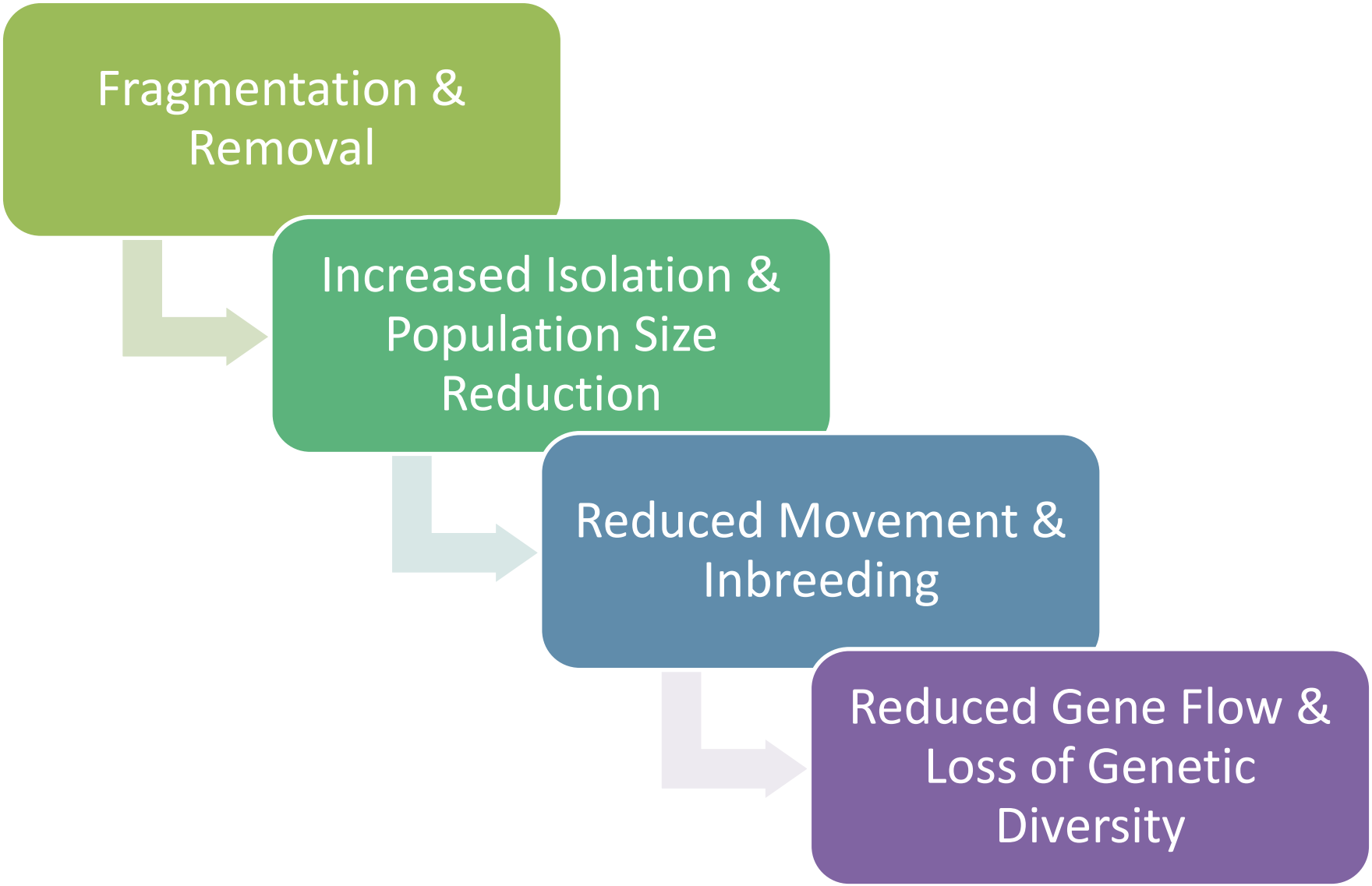

Overview

Habitat Fragmentation



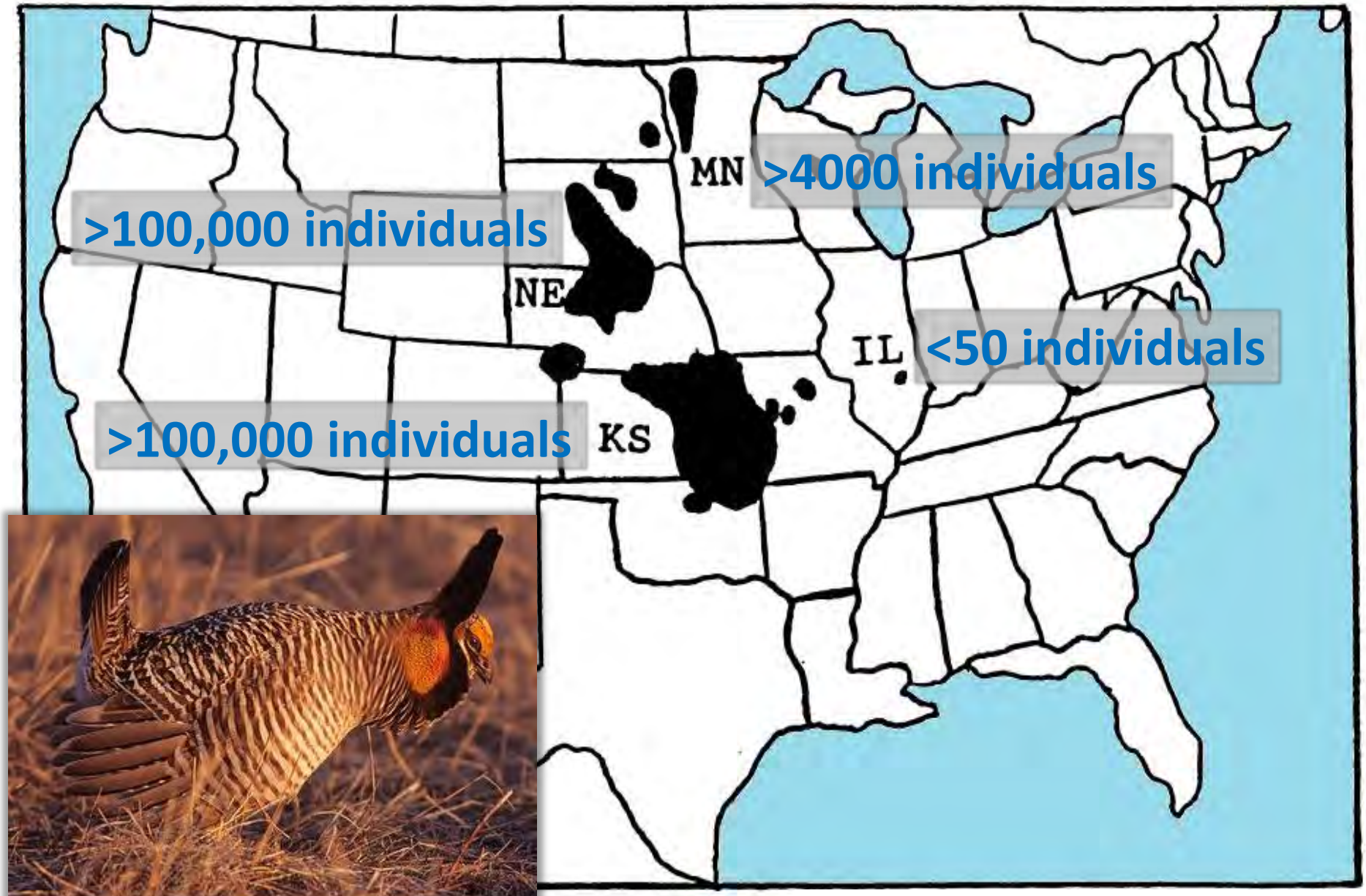
Habitat Fragmentation

Habitat Fragmentation



Greater Prairie Chicken

Greater Prairie Chicken



(Bouzat *et al.* 2008a, Bouzat *et al.* 2008b)

Greater Prairie Chicken in Illinois

Demographic Data

Population Size

1933: 25,000

1962: 2,000

1993: 50

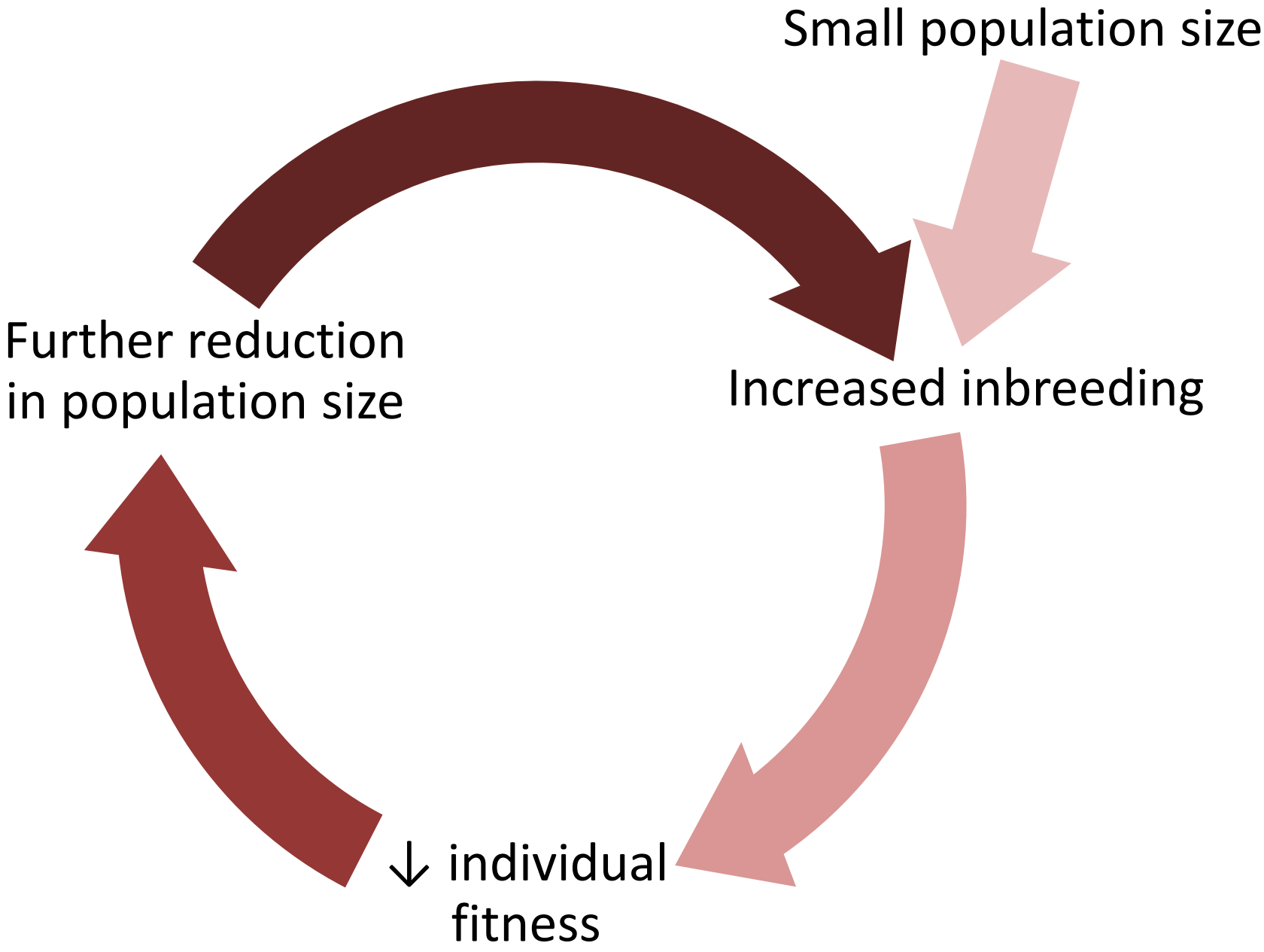
Hatching Success Rate

1960 – 90%

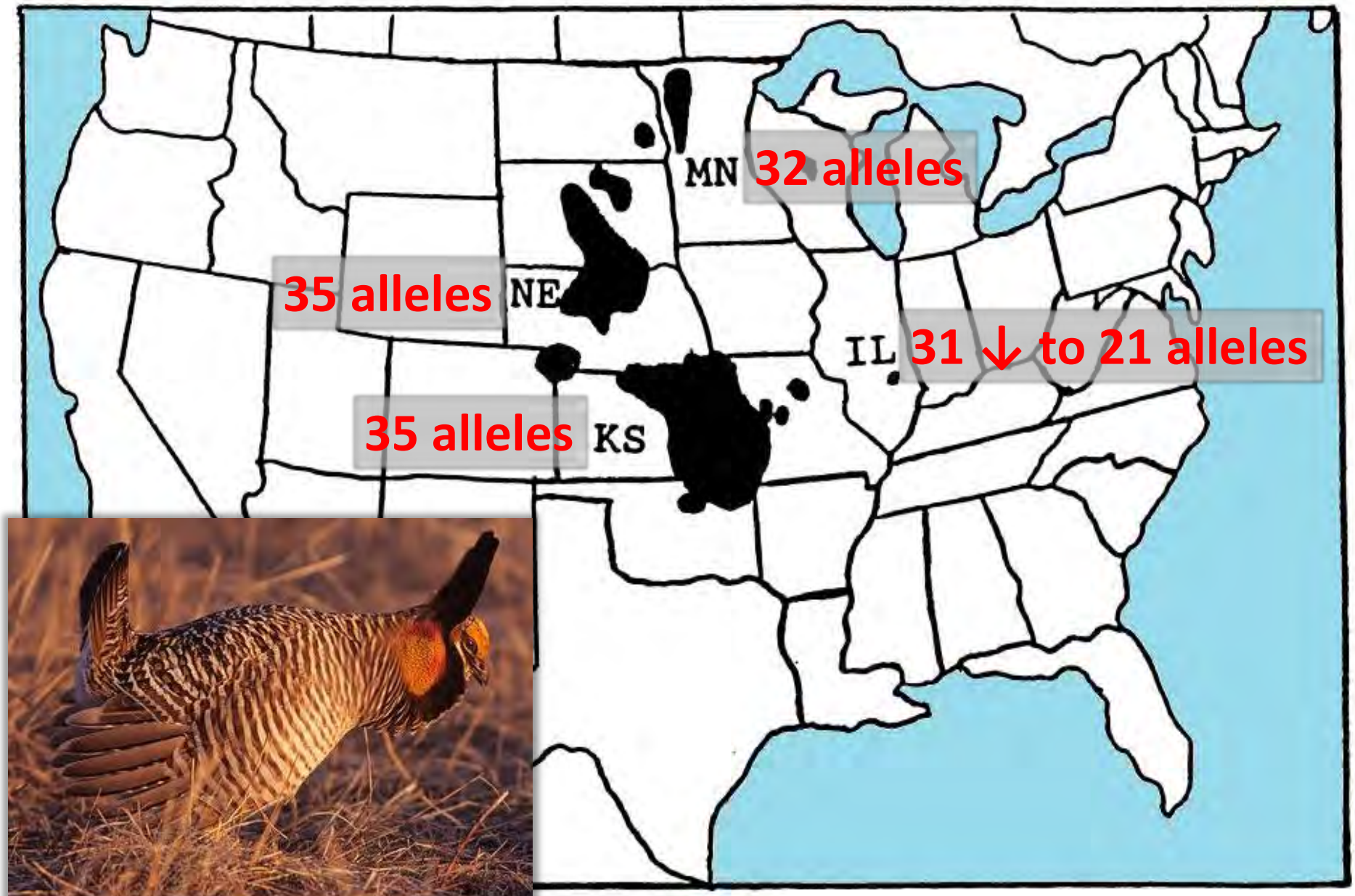
1990 – 74%

(Westemeier et al. 1998)

Small Population Size



Greater Prairie Chicken in Illinois



(Bouzat *et al.* 2008a, Bouzat *et al.* 2008b)

Greater Prairie Chicken in Illinois

Demographic Data

Population Size

1933: 25,000

1962: 2,000

1993: 50

Hatching Success Rate

1960 – 90%

1990 – 74%

Genetic Data

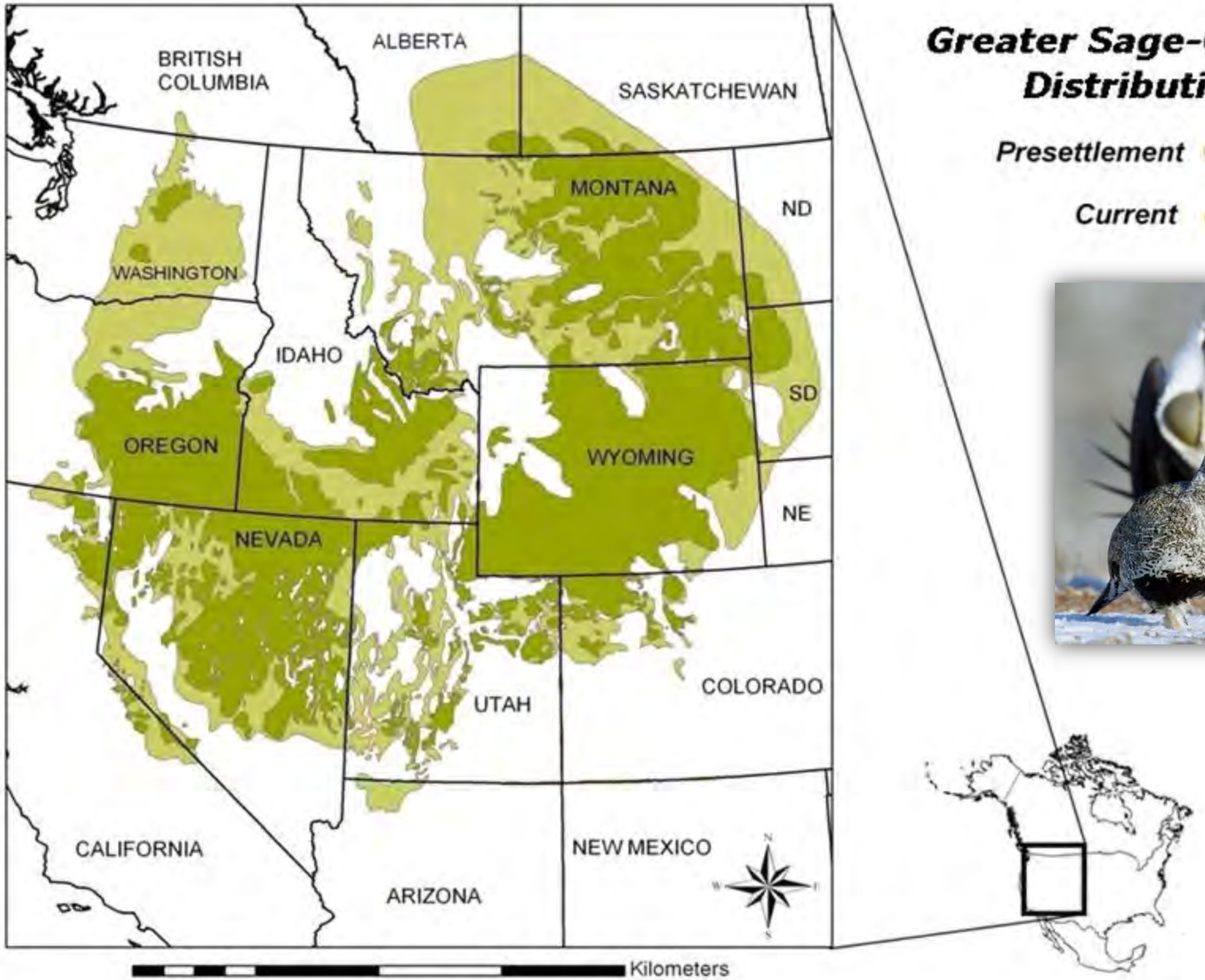
1960-1990 Genetic Variation Declined 30%

Introduction Effort

Hatching Rate Success ↑ for MN x IL & KA x IL to 94%

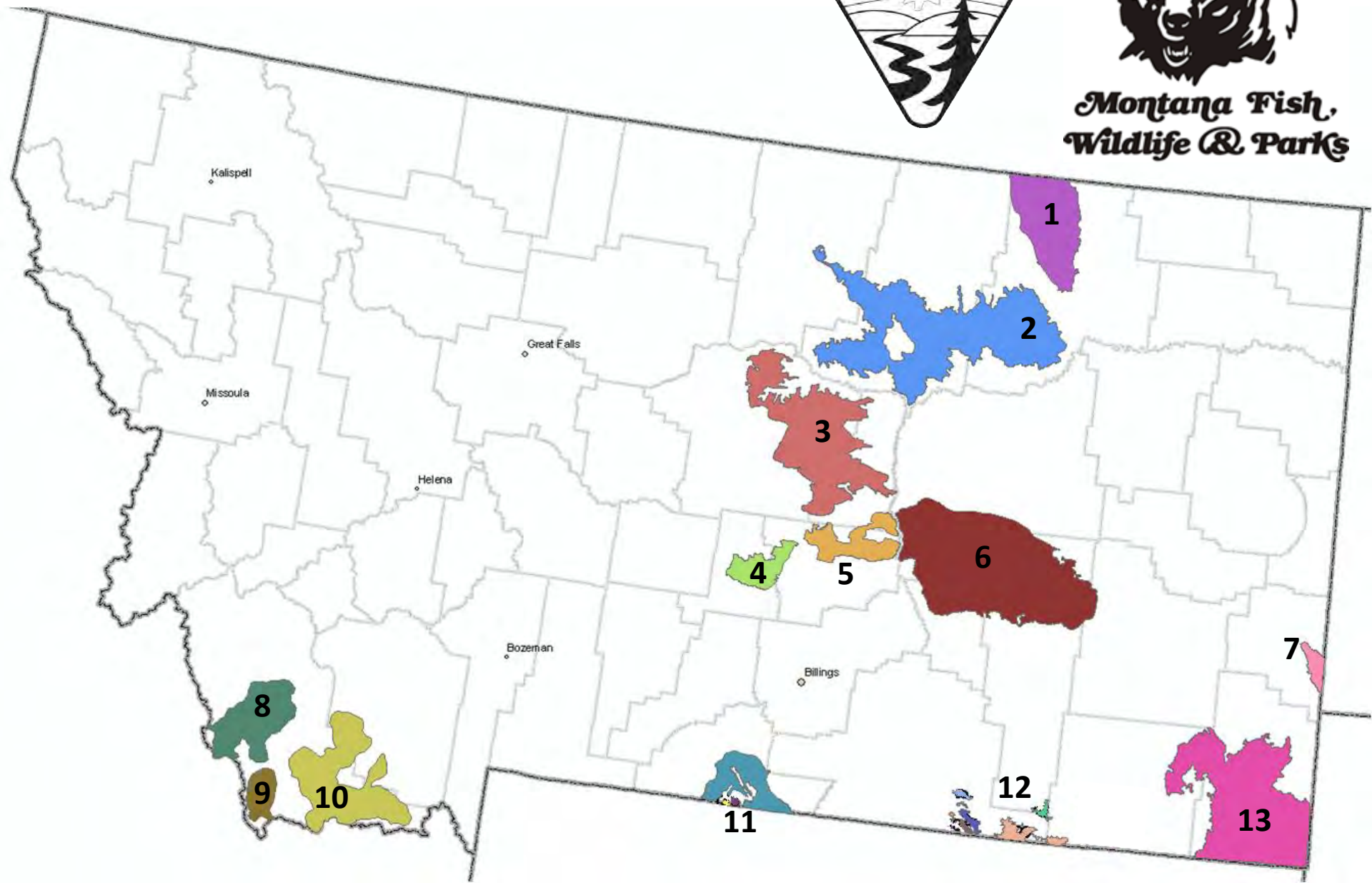
(Westemeier et al. 1998)

RANGE CONTRACTION & FRAGMENTATION



(Connelly et al. 2004 after Schroeder et al. 2004)

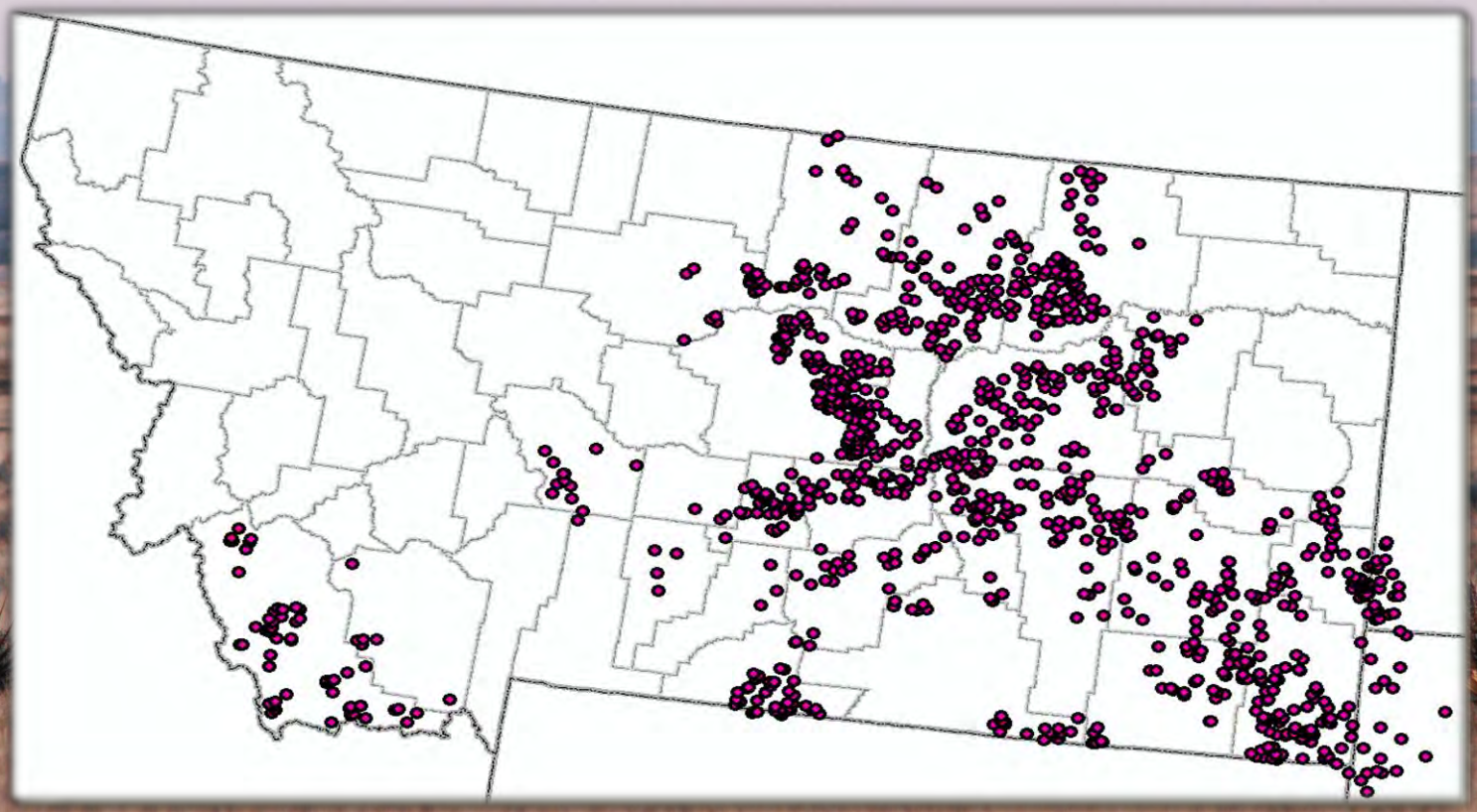
13 Core Breeding Areas



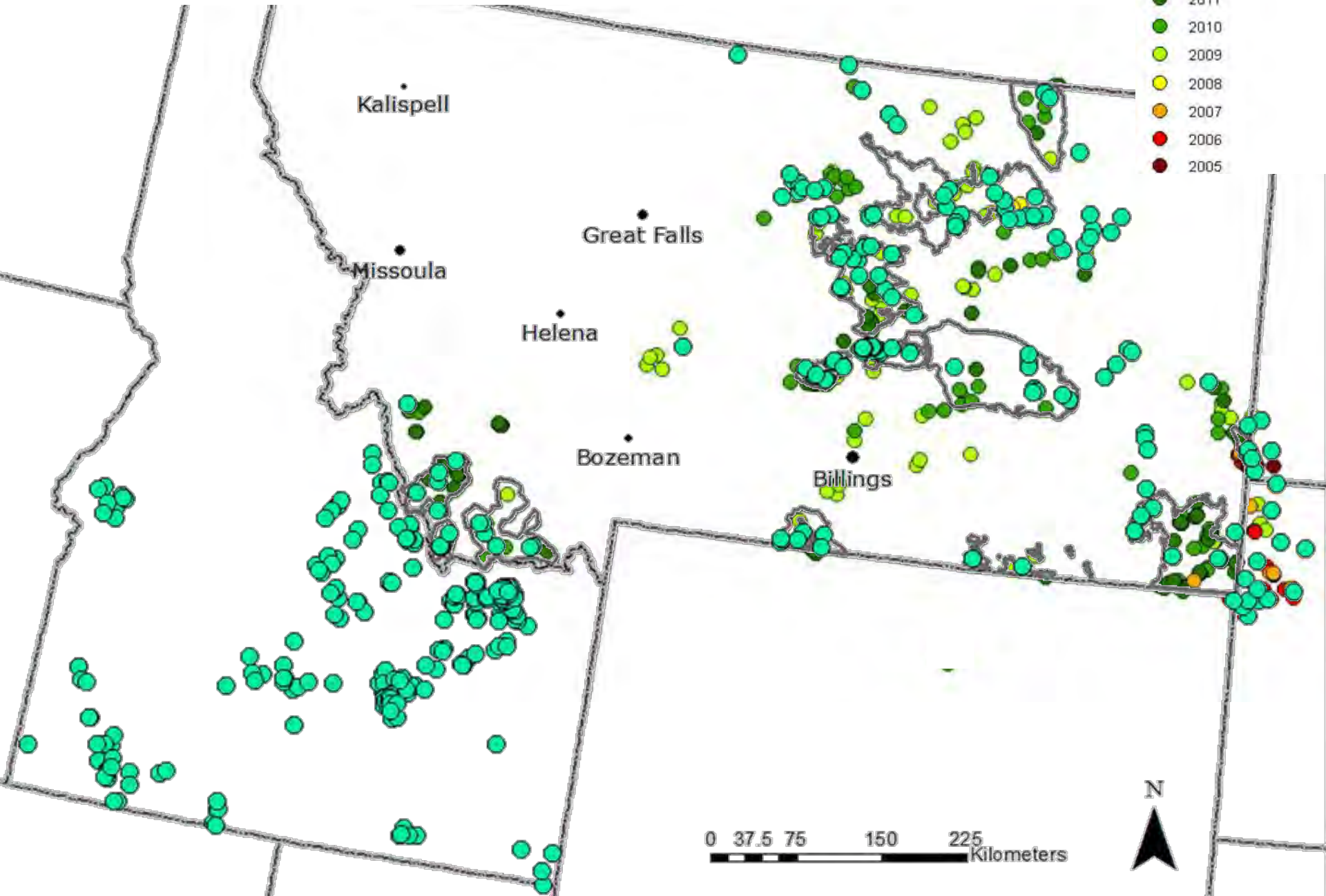
Overarching Goal:

To delineate greater sage-grouse conservation units to conserve the genetic structure, connectivity, and Genetic variation across a changing landscape

Sampling Unit – The Lek



NORTHEASTERN RANGE

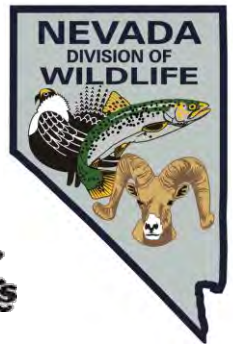


Sampling Effort

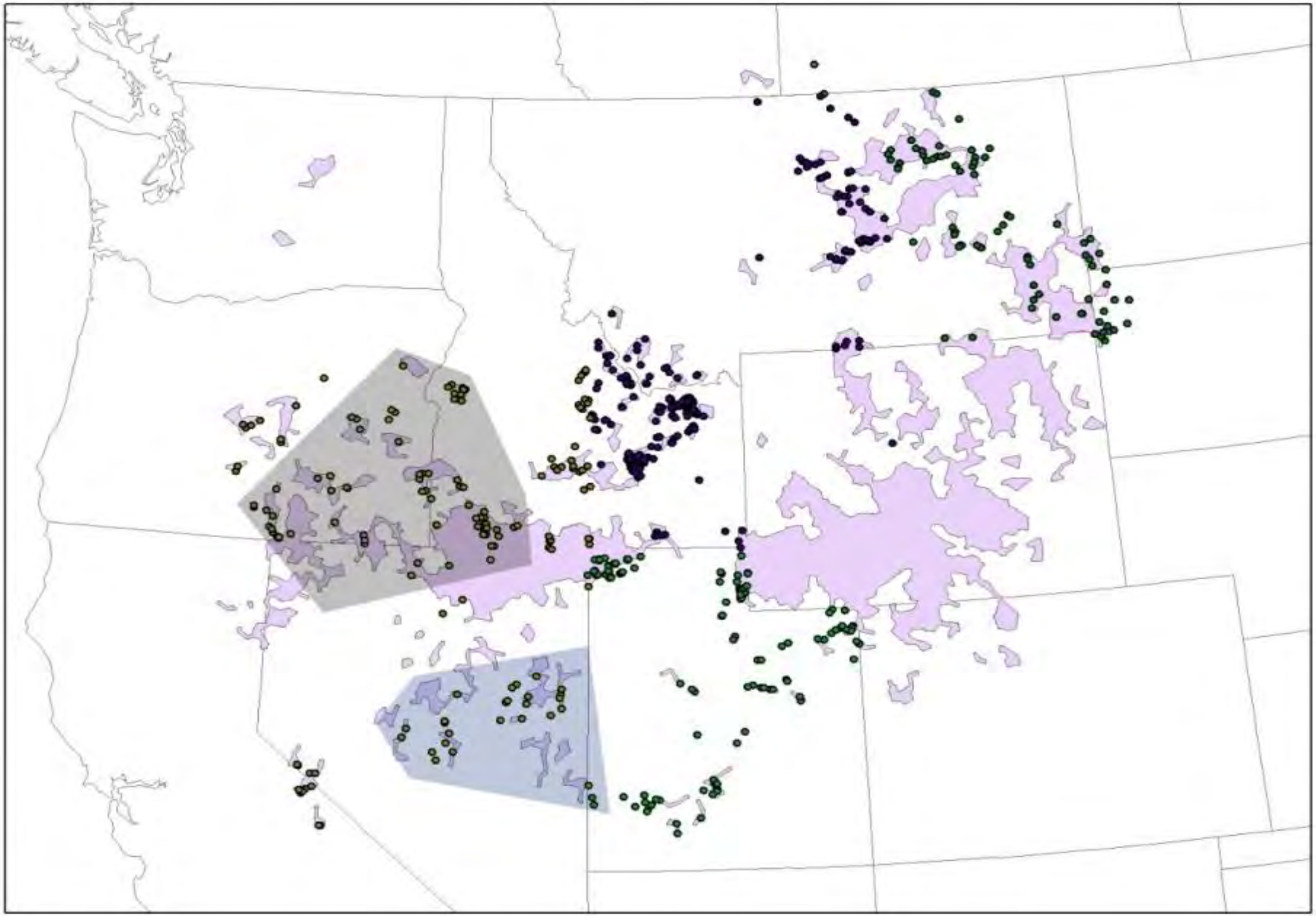
State	Total Leks	Total Feathers
ID	224	2686
MT	467	5730
ND	9	221
SD	18	318
TOTAL	718	8955

RANGE-WIDE GENETICS

Extended Application

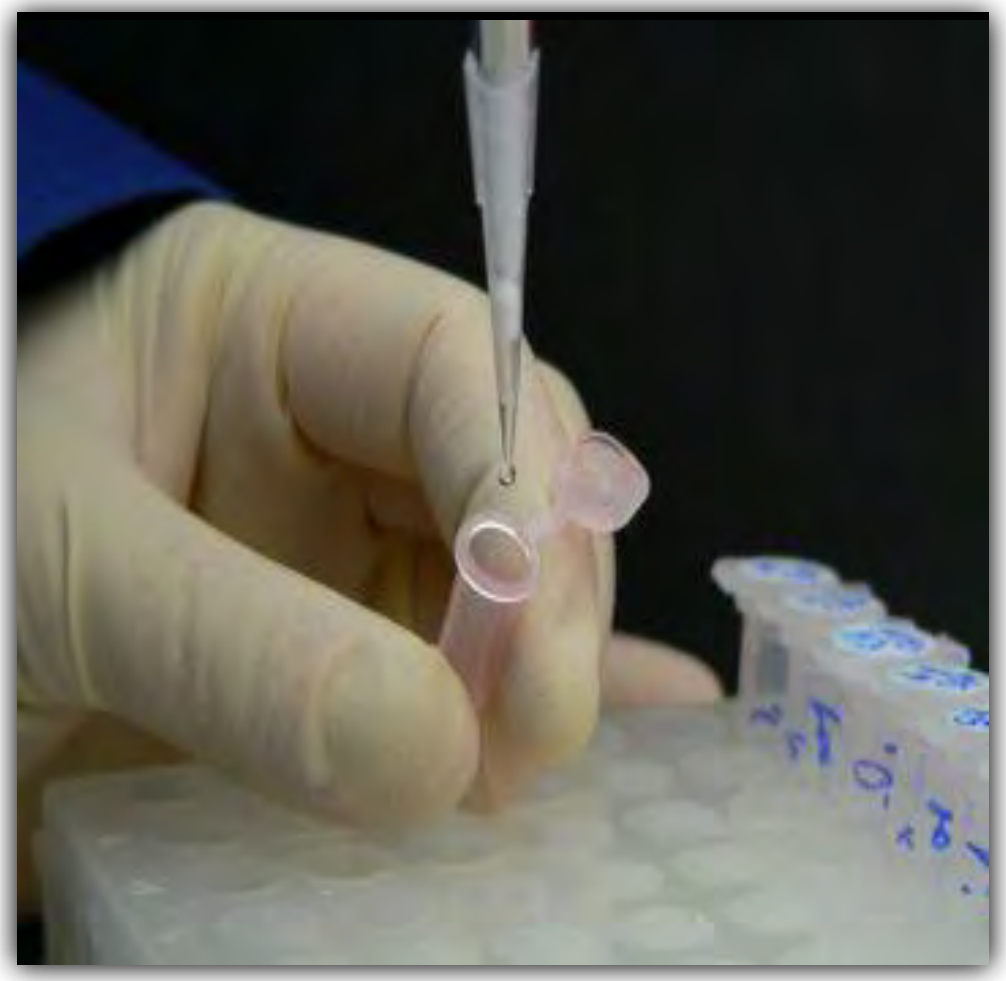


RANGE-WIDE SAMPLING



(image courtesy of Steve Knick)

DNA Extraction & Processing



	Extracted	Amplified	Individuals
Current	3792	2911	1620
Expected	5000	5000	3500

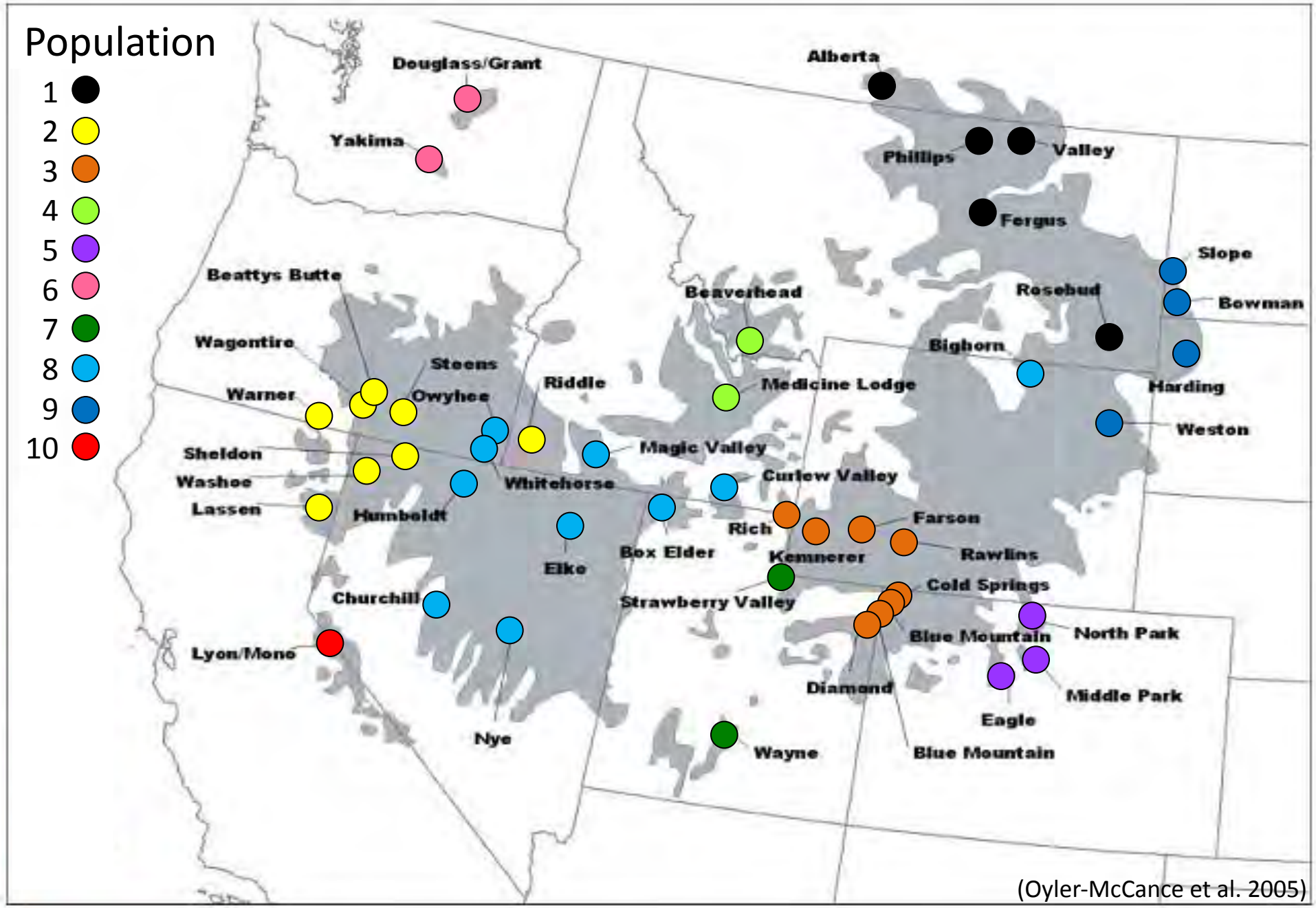
DEVELOP HIGH RESOLUTION GENETIC MARKERS FOR INCREASED POWER OF ANALYSIS.

Goal 1

IDENTIFY POPULATION STRUCTURE.

Goal 2

Previous Genetic Research

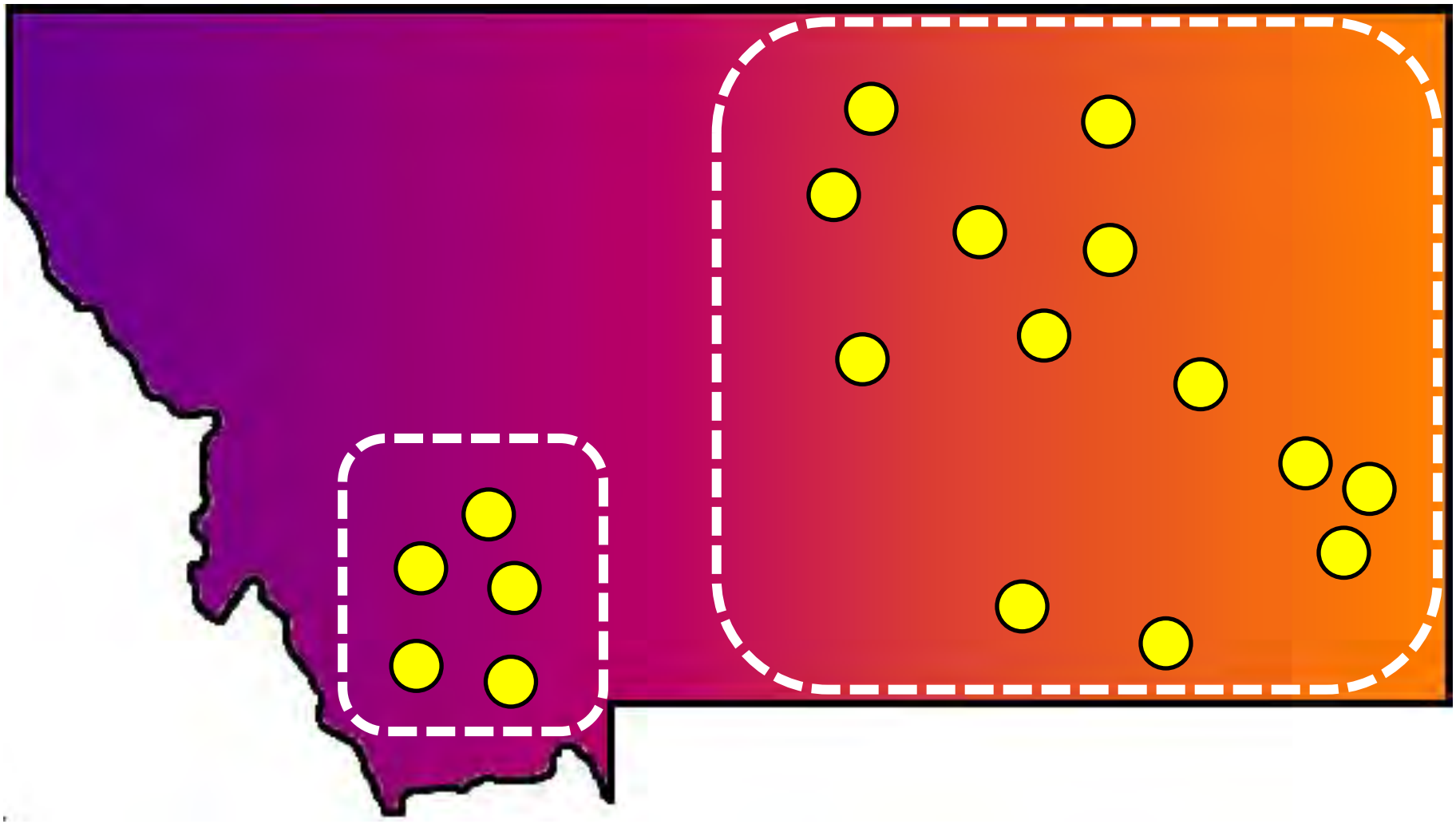


(Oyler-McCance et al. 2005)

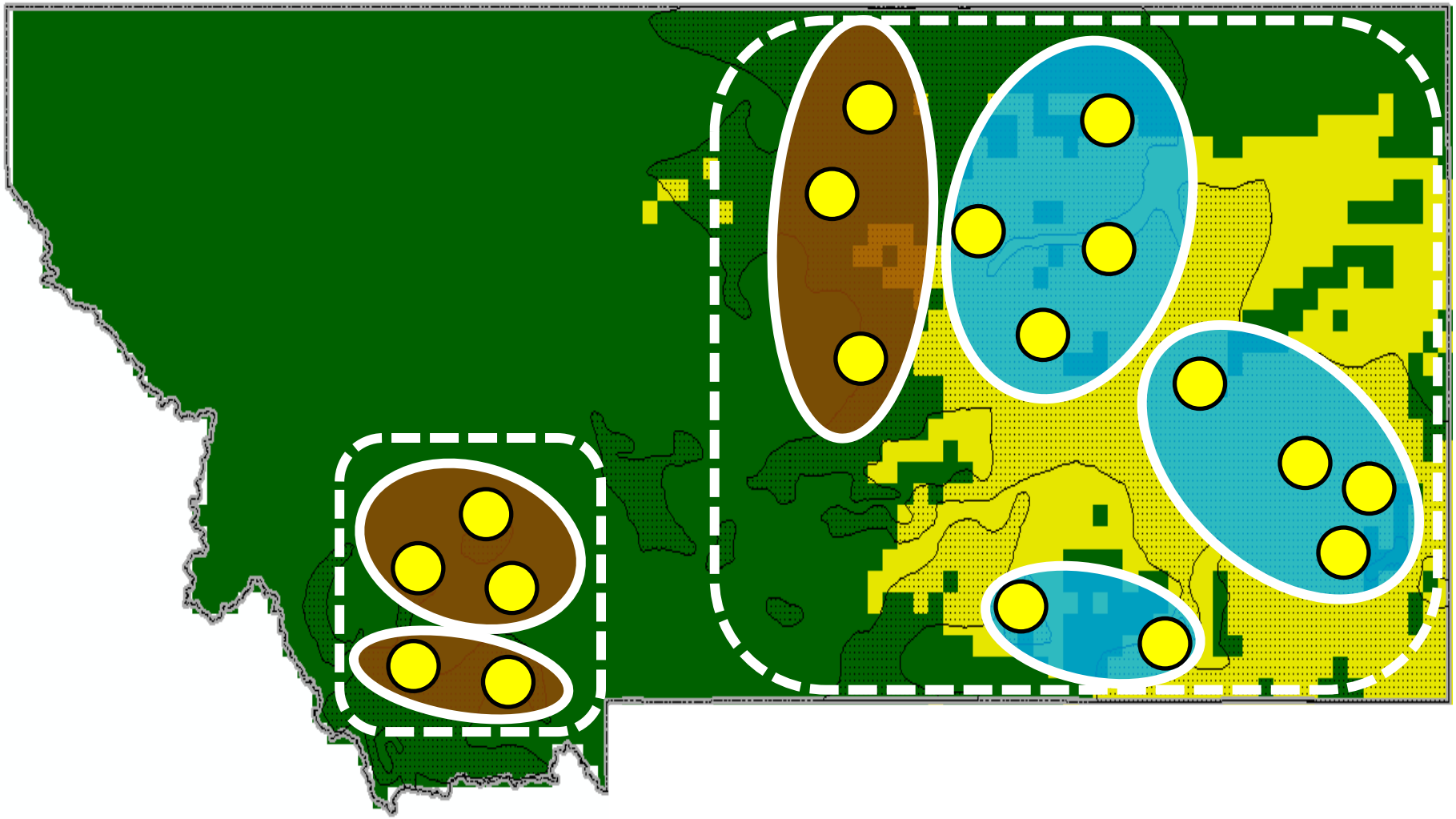
a. Does genetic population structure exist?

(Funk et al 2012)

b. Where are the major breaks in genetic continuity?

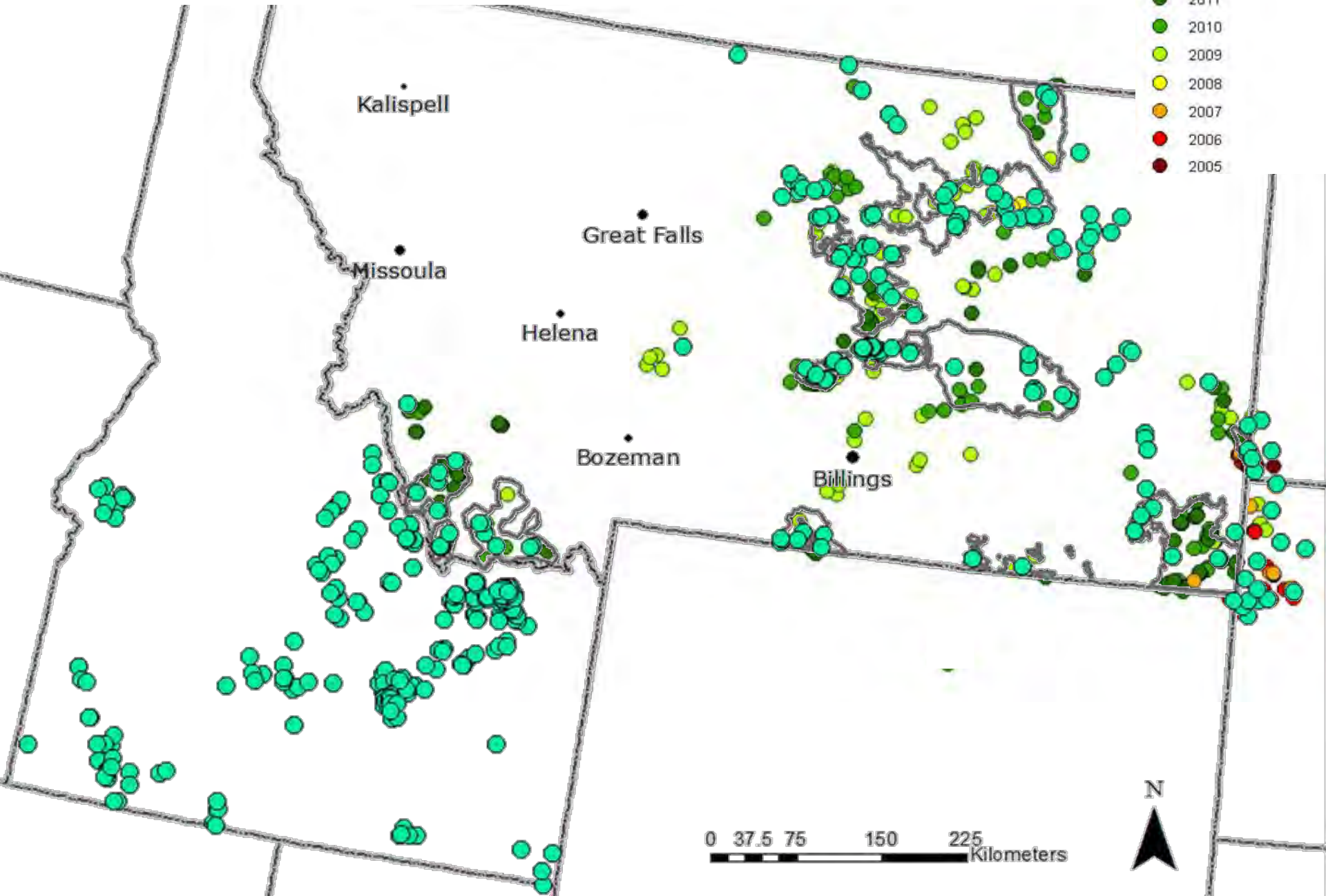


c. What is the genetic composition of each subpopulation?



(Funk et al 2012)

NORTHEASTERN RANGE



ASSESS OF THE EFFECT OF LANDSCAPE FEATURES ON GENE FLOW

Goal 3

LANDSCAPE DISTURBANCE

Disturbance reduces lek attendance leads to extirpation

(Knick et al. 2013)

rivers

roads

cultivated cropland

energy development

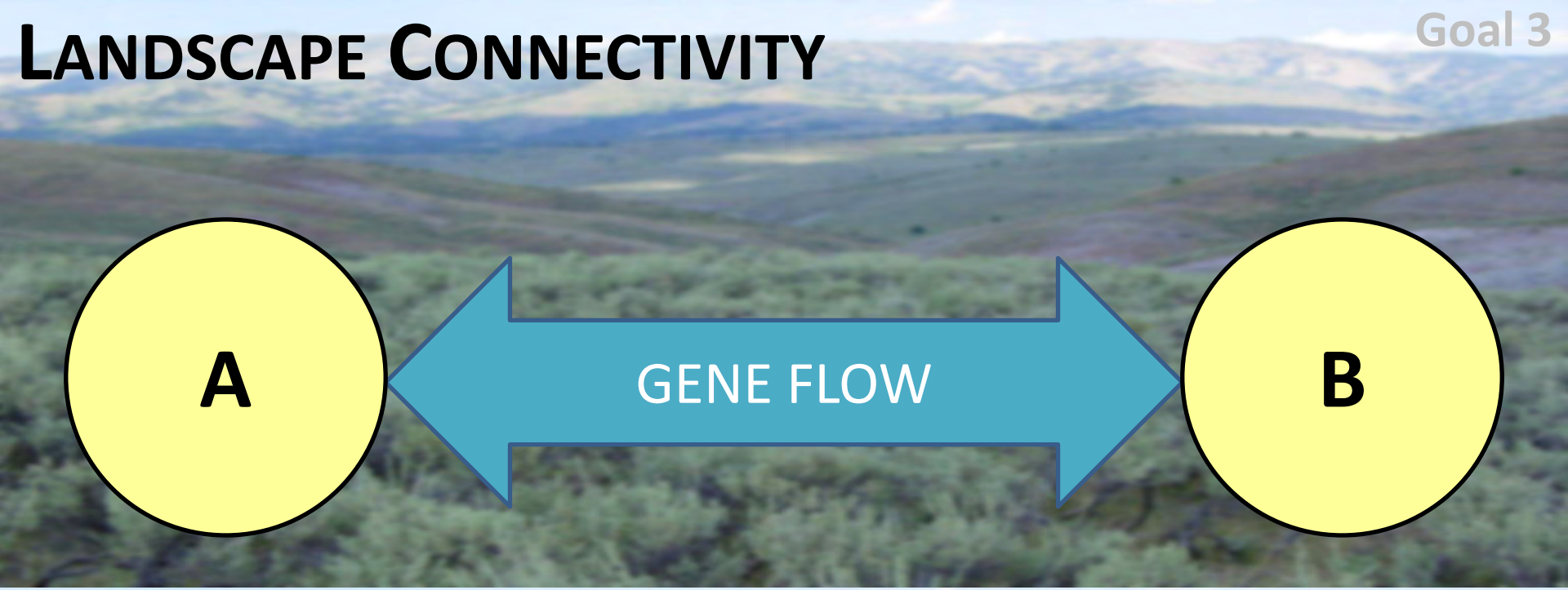
sagebrush land cover

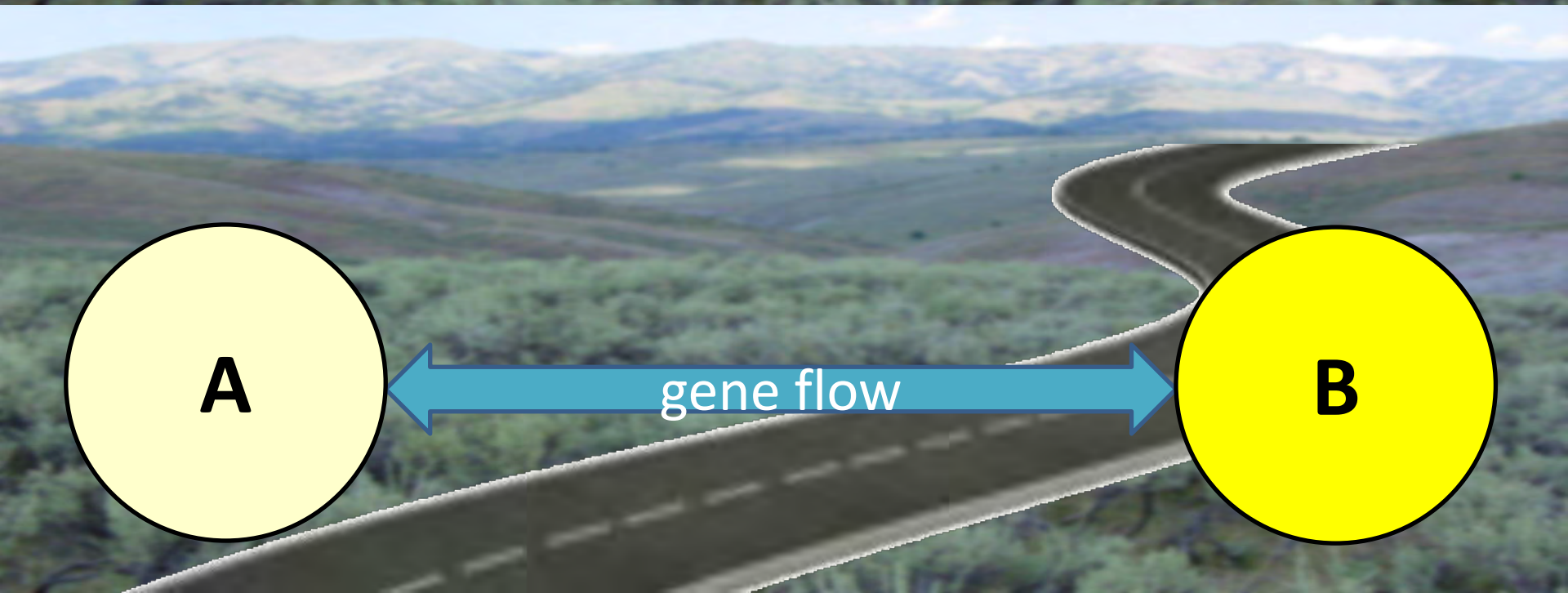
conifer encroachment

human population density

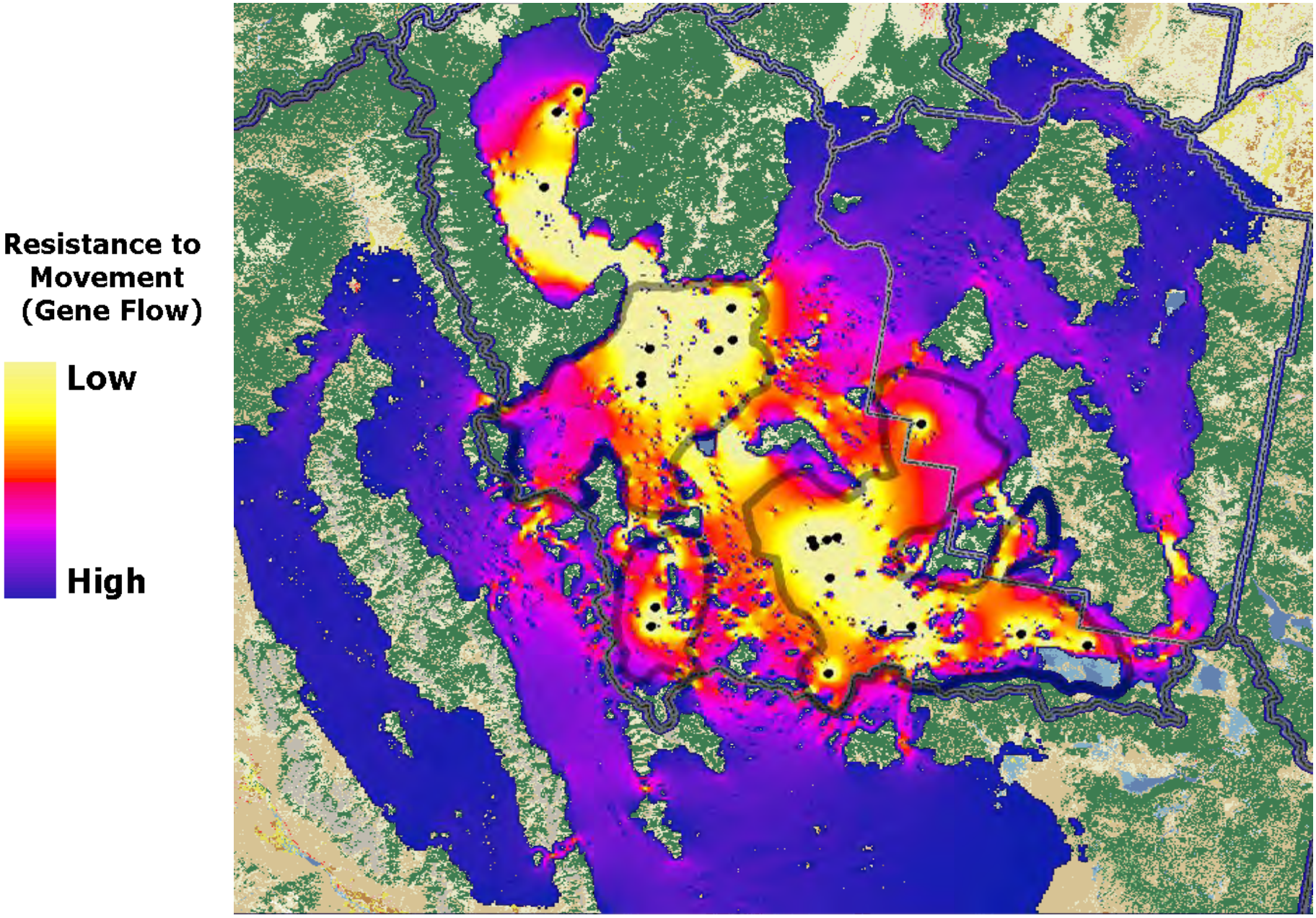
(Patterson 1952 ; Remington & Braun 1991; Lyon & Anderson 2003 ; Holloran & Anderson 2005 ; Aldridge et al. 2008; Knick & Hanser 2011; Johnson et al. 2011; Johnson et al. 2011)

LANDSCAPE CONNECTIVITY

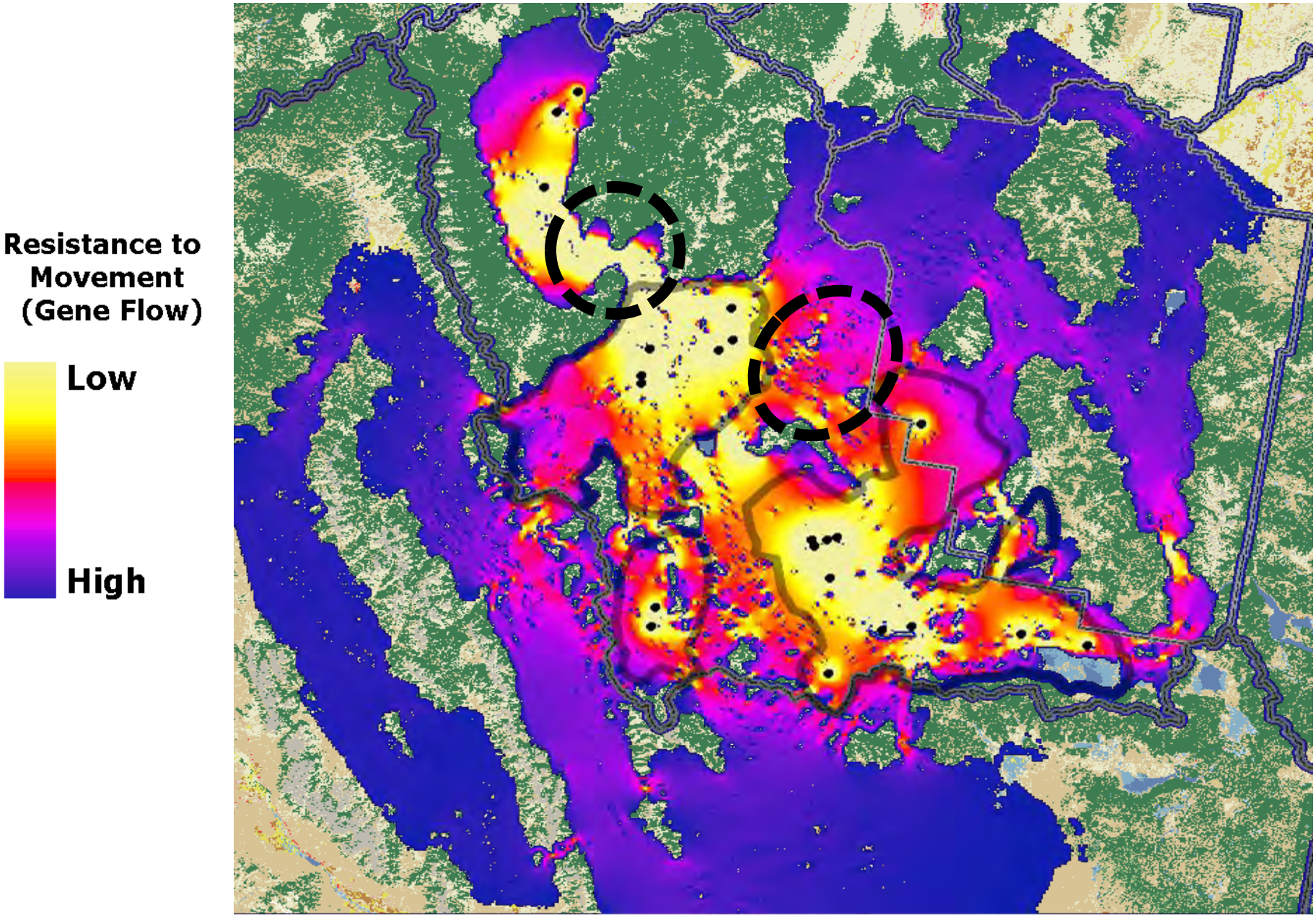




Connectivity Map Creation



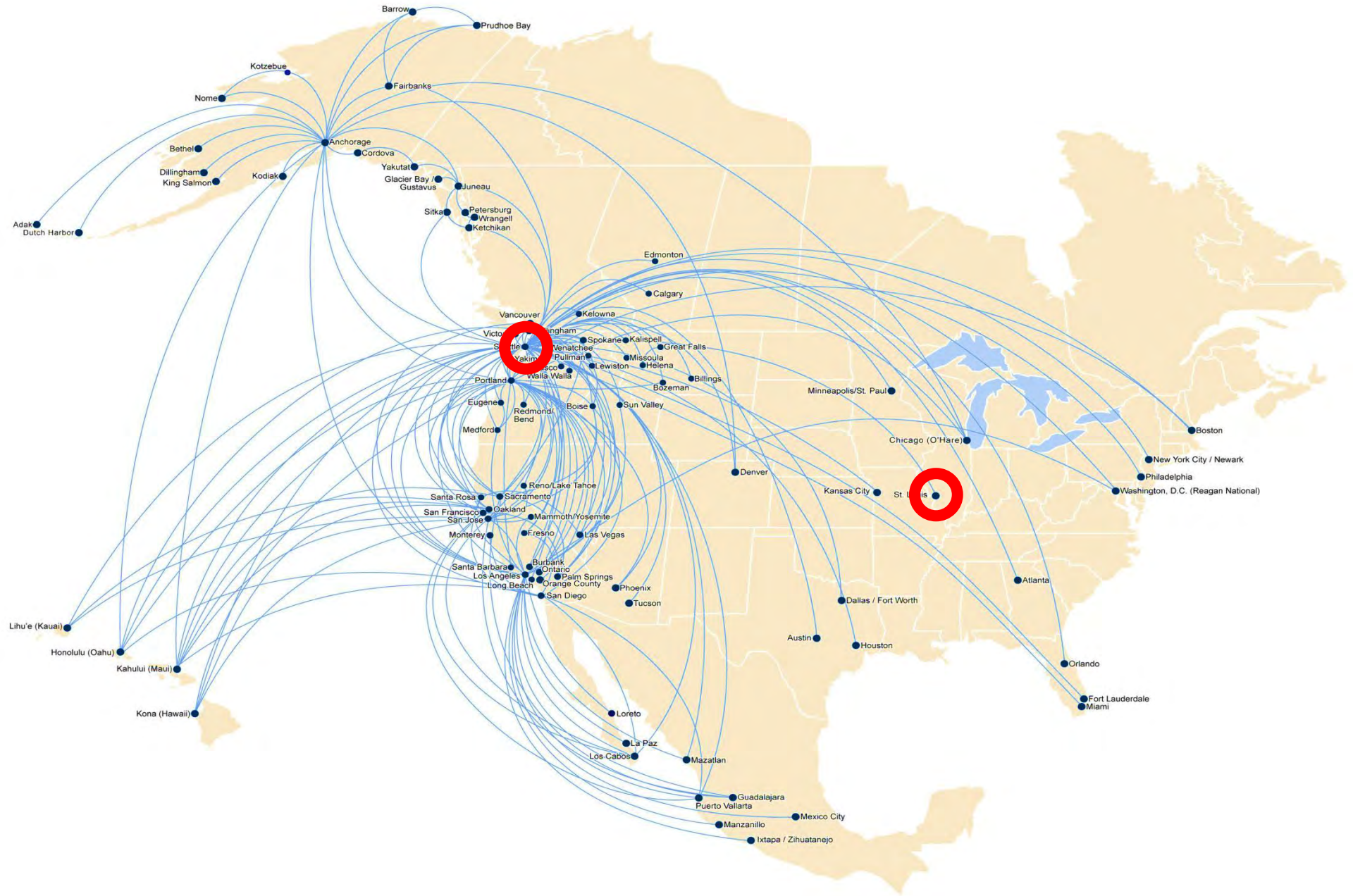
Connectivity Map Creation



MODEL THE RELATIVE IMPORTANCE OF EACH LEK TO MAINTAINING POPULATION CONNECTIVITY AND PERSISTENCE.

Goal 4

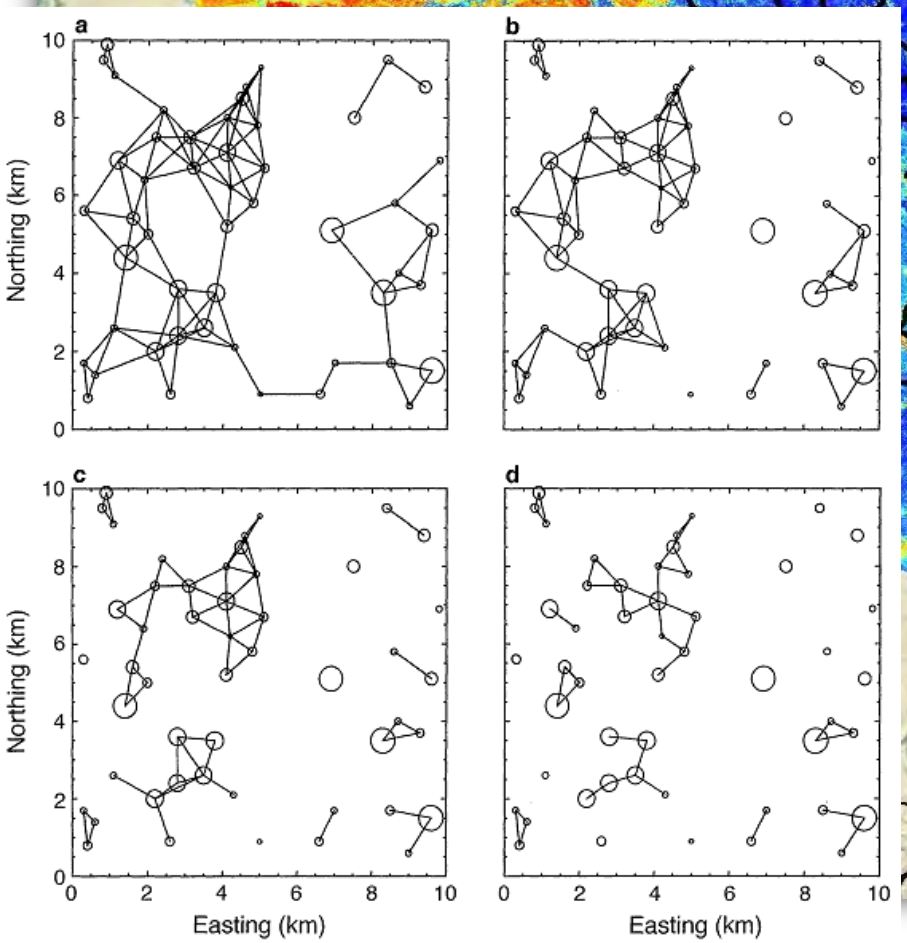
REAL-WORLD NETWORKS



Graph Structure - Wildlife

(Bunn et al. 2000)

NETWORK RESILIENCY



Intermountain West Joint Venture
Conserving habitat through partnerships

Great Northern
LANDSCAPE CONSERVATION COOPERATIVE

SAGE-GROUSE INITIATIVE

NRCS
Natural Resources Conservation Service

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

FOREST SERVICE
U S
DEPARTMENT OF AGRICULTURE

Montana Fish, Wildlife & Parks

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Montana Audubon